April 14, 2004

BTeV's Response to March 30-April 1, 2004 Directors Review Recommendations

WBS 1.1 (Magnets & Beam pipes)

1. The schedule and documentation needs to be updated to reflect recent changes and all the documentation needs to be proofread before the Lehman review. The breakout presentation needs to include much more detail about the project.

We will expand breakout talks.

2. The TDR should include a clearer discussion of the field nonuniformities in the B2s.

We redid the simulation and added words to TDR

3. A discussion of the safety issues associated with the fragile Be beam tube should be included in the TDR. How is it protected? Any special handling? What happens if it ruptures? Will there be contamination issues?

We added words to TDR, but are not sure how to handle potential contamination issues yet; will contact CDF for information.

4. The BOEs should be beefed up significantly to meet CD-2.

We will work on these.

5. Complete the magnetic modeling of the VM with the final pole pieces and the TM's with the 2.5 cm gap between the B2s before CD-2. These tasks were not broken out in the cost and schedule.

We clarified the wording on the VM simulation and updated the TM simulation

WBS 1.2 (Pixel)

1. Finalize the RF shield study as early as possible to minimize risks to the subsequent design

We will have something at the breakout session. Gerry Jackson will be available on April 28.

2. Add info on cost, schedule, risk, org-chart, and milestones to the pixel talks that will be presented at the Lehman review.

My (Simon) mistake. I had everything prepared but the technical session took the whole morning. For next time, besides the material in the plenary talk, I'll give an overview talk including cost, schedule, risk etc for the breakout session

3. Revise documentation to emphasize that baseline has been defined and to indicate clearly which among competing technologies has been chosen, where studies of the backup technology will continue, ensure that the motivation is explained clearly.

Sally talked to me a couple of times. I'll add one paragraph on the sensor and two sentences in the bump bonding which will say we have chosen the technology for our baseline. Test beam is used to confirm that the new detectors perform as expected , especially after irradiation.

4. Continue studies of impact of cooling

We are doing this anyway which they noted in the findings. Mayling will prepare a new document.

5. Expand TDR to describe more thoroughly the details of the module design and the R&D that remains to be done to complete that design,

We have added material to the TDR

6. Continue to develop a robust module assemble procedure.

We are working out a procedure to present at the Lehman review.

WBS 1.3 (RICH)

1 Continue to scrub the milestones. Make sure that finish as well as start dates are available for major items. Add mirror installation milestones to the assembly hall tasks. A sub-set of "Level 1.5" milestones would be beneficial for over-all project co-ordination.

Producer and consumer milestones have been added to define links with other projects. The level 2 milestones now define the beginning and end of the major acquisitions and of the major construction subprojects as well as the critical steps towards installation in the collision hall.

2 Continue to flesh out the basis of estimate, especially the section on the RICH vessel construction examined during the breakout session.

The WBS dictionary and BoE have been expanded in several sections, including the mechanical section reviewed in the breakout session.

3 Clarify the WBS Dictionary and Basis of Estimate section of the Management Notebook.

This inadvertently omitted due to an error and now has been repaired.

WBS 1.4 (Electromagnetic Calorimeter)

1. The collaboration should make every effort to accelerate the procurement of crystals either through forward funding or by qualifying 3 vendors.

We will certainly be making effort to secure forward funding to accelerate crystal acquisition. Qualifying Apatity is partially done, but it will be useful to acquire and test full-size crystals.

2. More effort, including models and prototypes, should be applied to understanding the mechanical issues behind the calorimeter to ensure that the cable and fiber plant does not impede adequate airflow.

We will be building a mock up of things behind the crystals following the reviewer's suggestion.

3. The thermal calculations should be repeated with a larger temperature variance in the C0 collision hall

The older calculation can be updated (or re-interpreted) to deal with situation when the C0 temperature varies more than 1 C. Our project engineer does not believe that the temperature variations will be more than 1 C, however. The reasons are:

1. The CDF hall temperature data suggest that temperature in the C0 hall will be very stable, much better than 1C, except during access time. Because of the thermal mass of EMCAL, short access will not effect its temperature.
2. After a long access time, when the hall temperature is much different from the regular running temperature, it will take some time for EMCAL to reach a stable temperature.
3. In case that C0 hall temperature swings much more than B0 hall, the existing calculation can simply be scaled in terms of temperature swing inside, or need to increase the air flow rate. So there is no need to re-do the calculation.
4. We will look at the tradeoffs of these changes when we do more detailed design of the environmental enclosure.

WBS 1.5 (Muon)

1. Complete the WBS Dictionary.

This work is in progress. We will complete it by the end of May.

2. In conjunction with BTeV management, review the contingency estimates.

In a prior finding, it was suggested that our contingency on the steel tubes was too low at 50%, apparently 75% contingency is now standard on steel. On the other hand, our contingency on other items was considered to be general too high. Tthe suggestion was that the overall total contingency was about right. We will raise the contingency on the steel tubes. We will also lower the contingency elsewhere, to come into line with the findings of the Temple review. We anticipate completing our changes by the middle of June. We will then request a review by BTeV management.

3. Add information on cost, schedule, risk, organization chart and milestones to the general muon talk that will be presented at the April Lehman review.

Many of these items were already in the talk given at the March Temple review (cost, organization chart). The rest will be included. BTeV management is also working on standard versions of these items.

4. Increase the toroid gap between the steel and the chambers to at least one inch. This will require coordination with other impacted subprojects.

A meeting was help on Monday, April 12 of all impacted and interested parties. The problem that prompted this recommendation was concern over build up of tolerances: the reviewer felt that the design did not make it clear how such build ups would be dealt with. We need 15-1/2" of gap in the middle of the toroid assembly for the muon detectors. This includes all tolerances for the muon system. At the April 12 meeting it was shown that when the toroid assembly was constructed, the gap would be fixed at that point: after that the assembly would move together as a unit so no changes in the gap would occur. It was also shown that when the toroid is assembled, a 15-1/2" gap will be preserved (by the inclusion of a box of this width if necessary). Tolerance build up will then be dealt with by adjusting the thickness of the toroid steel, which is possible because the full thickness requires thin steel plates to be added to each face.

5. Consider the Penn ASDQ custom ASIC as a candidate for forward funding. The order for these chips must be placed before the fabrication process is no longer commercially available.

This acquisition has been added to FY05 in our WBS. We are considering moving some items out of FY05 to FY06 to compensate, but will wait until after the Lehman review to investigate these (we are concerned about making too many quick changes right before the review).

WBS 1.6 (Straw)

1. Expedite the acquisition of the ASDQ.

We have firm quotes from Mitch Newcomer (UPenn) on the ASDQ. It would be easily possible to generate both a PO and Sole Source to order the ASDQ's, provided funding was available. Of course I assume that the Muon Group would do the same thing so that our total order could be made together (to get to the 10000 count price break).

2. Work with the lab to advance the ASIC TDC development.

We have talked with Ray Yarema to try and expedite this process. We have been told that an ASIC designer would be available in mid-May. However we have expressed a desire to begin the specifications dialog now with people in Ray's group so that we can converge on a do-able set of specifications.

3. Work to complete the milestone of prototyping a full scale 1/2 view including FE electronics. Current 96-channel prototype was built at Fermilab. In addition to crystalizing the module -0/1 technical design, building the full scale prototype is a training exercise for all the collaborators involved in the production.

This process is underway (materials have been ordered and received). Recalling that we have only recently (March 2004) received a FY2004 budget, our current bottleneck is to get some funding to our collaborators. This is in progress. The FE electronics at this stage do not include the TDC mentioned in (2), but does include other prototype FE electronics.

4. Continue development of pattern recognition of non-pixel seeded tracking. This will help to tie RICH and ECAL analysis code development.

This effort is continuing and being lead by Penny Kasper. She has recently been joined by Mike Arenton of UVa.

5. Continue participation by all collaborators in the testbeam of the 96-channel prototype.

The Collaborating University groups (UVa, UHouston, and SMU) have just submitted a draft Run Plan for the Straw Test Beam Run which is set for April 23-May 2 2004. They will staff the entire run.

WBS 1.7 (Silicon Strips)

1 Conclude full engineering design of the silicon support and ladder. L3 managers and SiDet/FNAL personnel should be fully involved in the appropriate specifications and should verify that the required assembly techniques and tolerances are consistent with their capabilities. FEA and prototype modeling should be continued. The overall design should be reviewed by BTeV as soon as design calculations and prototype tests are available.

We agree and are working on this.

2 Scrub the open plan schedule for consistency in form and content with other subprojects. The schedule should provide a critical path analysis with individual task floats.

We are now consistent with the other subprojects; We will provide an additional & detailed discussion of the critical path analysis.

WBS 1.8 (Trigger)

1. Develop the design of the level 1 switch further, perform an analysis of its behavior under simulated conditions, and implement a smaller test version as early as possible.

We have started to work on a small test version of the L1 switch in response to the Temple 2004 recommendations. We will have performance results by Summer 2004.

2. Continue the exploration of DSP alternatives for the level 1 farmlets, taking into account all factors, including I/O capabilities, compatibility with the inter-process communications framework, etc.

We consider the exploration of DSP alternatives for L1 to be one of our highest priorities during the next few months. We have several members of the trigger group working on the evaluation of alternatives. The work is directed by Michael Wang of the Fermilab Particle Physics Division.

3. Continue evaluation of the commercial message-passing operating system developed by OSE.

Evaluation of the OSE message-passing system is considered to be part of the exploration of DSP alternatives. The work is being done by members of the Vanderbilt RTES group, and is supervised by Jim Kowalkowski of the Fermilab Computing Division.

4. Develop a well-structured, comprehensive set of milestones for level 3 software development.

Milestones for L2/3 software development have been developed, and have been included in OpenPlan.

5. Develop a set of objective criteria to determine when a subdetector's raw data can be suppressed.

We have established a working group that is looking into data suppression and data compression. The group will report its findings later this year.

6. Identify manpower to contribute to the level 3 software development.

We have started to identify manpower for L2/3 software development
by contacting BTeV collaborators.

WBS 1.9 (DAQ)

1 Fully specify the inputs to the DCBs for each subsystem, and build a prototype for at least one of these.

We will be starting the detailed DCB Design Specification in May, with the goal of merging the requirements of the Pixel and non-Pixel DCBs. The only significant difference in the two designs is in the detector interface. The Pixel version will accept up to 144 serial data links at 140 Mbps each. All communication with the Pixel subdetector is through the Pixel Feedthrough board, allowing the use of high density connectors. The non-Pixel version will accept up to 48 serial data links each with a throughput rate of 600 Mbps. These links connect to individual front-end modules. Both DCB types will use a common base design and packaging. An application-specific interface card will provide either 16:1 multiplexing (Pixel) or 4:1 multiplexing (non-Pixel) to arrive at a standard 2.4 Gbps input rate. The remainder of the DCB processing circuitry is identical. Clock and control signals to the subdetector are generated by programmable logic and are adaptable to any detector-specific format. Signal level conversion and fanout is handled by the application-specific interface card. We now plan to begin development of the first pre-production DCB, with Pixel interface, in early FY05. This will be followed closely by development of the non-Pixel version of the interface and testing with Muon front-end hardware.

2 Design the clock distribution scheme and build prototypes for each of the custom elements (including the receivers on the front-end boards).

We are now at the point that we can also start the detailed Timing System specification. The Master Timing generator will be based on Tevatron BPM hardware which is already nearing design completion. The remainder of the timing and control logic is implemented in each DCB, and will be part of the integrated pre-production DCB design now scheduled for FY05. With the completion of the pre-production DCB and Master Timing system, we will have the ability to read out (at limited bandwidth) data from all subdetectors.

3 In the schedule, decouple the run control partitioning functionality from its use of databases.

We have added another release of run control that includes partitioning before the release that fully integrates the databases. Simply database-like alternatives can be used, e.g. flat files, until the actual databases become available in FY09. The partitioning release of run control should now be available in the summer of 2008.

4 Review the TDR draft and increase the level of detail where needed.

We recognize and agree that the TDR updates have lagged. Some new information has been added in the short window between the current review cycles, and we plan to do a more significant update of both text and figures immediately after this review.

WBS 1.10 (Integration, Installation & Testing)

1 The mechanical project engineer and the leader of subproject 1.10 should not be the identical person. This is too much work for one FTE.

We agree. The leader should be the Project integration physicist and he will require support from the project electrical & mechanical engineers at ~20% for the first 2 years and ~40% for the 2nd two years.

2 Complete the transfer of each subprojects installation narrative information into the schedule.

This is underway. 3 of 9 subprojects have been incorporated in to the schedule This process involves a dialogue with the authors of the installation plans to achieve a verifiable match between the installation plan and the implementation in Open Plan.

3 Develop an installation coordination plan prior to CD-2

a Develop a "sign-off" process between 1.10 and the sub projects to make sure that the common integration items match the detector subgroup specifications

b Identify the manpower and plan to handle the numerous ES&H issues

c Reexamine the FNAL manpower required in order to complete 1.10.

a The signoff process will be part of the document control procedure. The controlled documents will be the summary tables for infrastructure needs and the installation plans prepared by each subproject. Some subproject input is already linked to the infrastructure summary tables. All subproject input will need to be linked before a formal review and approval process.

b The schedule currently includes 2.25 man years of engineering assistance and an equivalent amount of physicist assistance for a total of 4.5 man-years preparing documentation for ES&H issues. This compares to a top down estimate of 6 man-years for CDF and 11.5 man-years for NUMI. We think the NUMI task is significantly more complex because of the underground construction. We think we are within a reasonable range of the CDF estimate and want to do a more detailed comparison before making any adjustments.

c When we are finished incorporating the subproject installation plans we will examine the FNAL manpower needs.

4 Incorporate infrastructure items into the list of milestones such as the completion of the gas mixing systems, electronics cooling water etc.

The infrastructure items will be incorporated as part a 2nd tier of milestones below the 1st tier major detector installation milestones.

5 Scrub the WBS plan – look for missing tasks and inconsistencies.

This is an ongoing task because there have been major revisions since the last review. However, I was puzzled by the reviewer comments about having a difficult time identifying the labor resources for the gas system and cable plant as these were reviewed and found within a minute while searching the open plan file. I think the recommendation and comment may have as much to do with needing to be more effective in communicating with the reviewer as with any schedule deficiencies.

6 Complete the cost estimates and BOE required in order to achieve CD-2

The major M&S cost items $25K have been completed. Smaller M&S cost items are continuing. We are also continuing to look for experience on other experiments to use as a labor benchmark

WBS 2.0 (Interaction Region)

1 Ensure that all of the plenary and breakout session talks clearly state the scope of work, and clearly and succinctly address the issues for CD-1. Hold serious "dry runs" for all of the talks prior to the review.

The C0 IR subproject will use the powerpoint template supplied by BTeV management for all talks for ensuing reviews. All talks will be rehearsed.

2 Assign accelerator physicists (~2-3) to participate in the finalization of the design in preparation for full CD-1 Review.

We have asked AD management to formally assign accelerator physicists to the C0 IR project. In particular, we have asked for assistance with beam tracking calculations.

3 Edit and update the CDR to ensure that the technical designs described therein are consistent with those shown in the review presentations.

Chapter 3 of the CDR (low beta quadrupoles) has been updated to reflect recent cryostat design modifications. Minor corrections have been made elsewhere to incorporate minor design changes and to correct errors. We will continue to update this document as needed at least through the CD-3 review.

4 Proofread the data entered into Open Plan, and correct the known errors those found during the proofreading. Include TD and AD management to ensure that the resources required can be made available.

We have already proofread ~80% of the Open Plan WBS, and will continue to flush out errors. In May '04 we will initiate discussions with TD and AD management on resource requirements for the C0 IR project.

5 Remove all spares costs from the TEC.

This has already been done by flagging spares in the Open Plan WBS.

6 Fill in entries for the WBS dictionary.

By now ~90% of WBS dictionary elements have been completed. We will complete the remainder in May '04.

7 Assemble and document the basis of estimate for all tasks.

BoE's have been entered in the Open Plan WBS for ~80% of all activities, and backup documentation is being collected.

8 Do a bottoms-up contingency analysis.

A bottom-up contingency analysis has been done for ~20% of WBS activities. All other activities currently have a 40% contingency, which we feel is appropriate at this time. We will complete the bottom-up contingency analysis before the CD-2 reviews.

9 Examine the strategies for placing procurements for long-lead items to minimize the FY05 cost.

This has been completed. FY05 base construction costs are now at 5.4M$ for the C0 IR subproject.

WBS 3.0 (C0 Outfitting)

1. Create an advanced conceptual design which will permit a rapid finish of Phase I Title II design once CD-3 is granted.

The benefits of starting an Advanced Conceptual Design to the project's schedule is clearly understood by the BTeV Project and Fermilab management. FESS Engineering is in a position to accomplish all but the detailed electrical design without any negative affects to other projects or issuing of a purchase order. The physical features of the electrical can be accomplished within FESS. Start of an Advanced Conceptual Design is awaiting management direction and the identification of funding.

2. Consider including a safety incentive in the estimates for construction.

A safety incentive will be considered during Title 2. If dollar incentives are employed contingency dollars will be used.

3.   Contingency has been increased from 20% to 25% to address the risk of improvement in the economy, which could result in higher bids.

Contingency for all elements of WBS was 20%. To account for an improvement in the economy, Phase 2 construction contingency has been raised to 22%.   This seems reasonable since recent bids have been very favorable, well below the engineer's estimates.